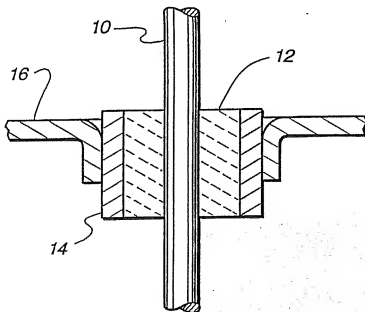




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/US90/05623 <b>(22) International Filing Date:</b> 3 October 1990 (03.10.90)  <b>(30) Priority data:</b> 419,881 11 October 1989 (11.10.89) US  <b>(71) Applicant:</b> MEDTRONIC, INC. [US/US]; 7000 Central Avenue N.E., Minneapolis, MN 55432 (US). <b>(72) Inventors:</b> TAYLOR, William, John ; 106 Yoho Drive, Anoka, MN 55303 (US). LESSAR, Joseph, Francis ; 3742 114th Lane, N.W., Coon Rapids, MN 55433 (US). <b>(74) Agents:</b> RISSMAN, John, A. et al.; Medtronic, Inc., 7000 Central Avenue, N.E., Minneapolis, MN 55433 (US).		<b>(81) Designated States:</b> AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).  <b>Published</b> <i>With international search report.</i>

**(54) Title:** CORROSION RESISTANT FEEDTHROUGH**(57) Abstract**

Use of Titanium and Titanium alloys (14) in combination with and CABAL-12 glass (12) for improved corrosion resistant feedthroughs.

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## CORROSION RESISTANT FEEDTHROUGH

1     Background of the Invention

2             Glass seals are used in various arrangements  
3 including batteries and other electrochemical cells. For  
4 example, in battery headers, glass seals are used to seal  
5 the battery container while allowing one or more  
6 electrical terminals to extend through the seal for  
7 interior/exterior connection thereto. The term  
8 "feedthrough" shall be used herein to describe such  
9 arrangements in generic fashion.

10            In batteries and the electrochemical cells,  
11 corrosion has been encountered. For example, batteries  
12 which include various organic electrolyte systems give  
13 rise to corrosion and cracking of glass and metal  
14 feedthrough components.

15            A special glass composition has developed by  
16 Sandia National Laboratories which exhibit improved  
17 corrosion resistance. It is generally referred to as  
18 CABAL-12 glass. Although this glass has desirable  
19 corrosion resistance and resistance to cracking, it has  
20 been difficult to find metals which will reliably wet the  
21 glass to form strong, hermetic seals with it and which  
22 work well with respect to the other aspects of seal  
23 forming such as weldability, expansion characteristics  
24 and so forth. The general purpose of this invention is  
25 to provide a combination of metal and CABAL-12 GLASS for  
26 improved feedthrough structures in battery and  
27 electrochemical cell applications.

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1    Summary of the Invention

2           This invention relates to feedthrough  
3 structures which utilize CABAL-12 glass particularly for  
4 use in aggressive battery organic electrolyte  
5 environments e.g., a lithium thionyl chloride cell or  
6 cells of other active chemistries such as  $MnO_2$ , and CFX,  
7 for example. It has been discovered that this glass has  
8 a unique affinity for sealing to titanium and titanium  
9 alloys. In its preferred embodiment the invention  
10 relates specifically to hermetic, corrosion resistant,  
11 compression-type sealed feedthroughs utilizing single or  
12 multiple terminals or pins of niobium, tantalum,  
13 molybdenum and titanium or alloy thereof, contained  
14 within a header or sleeve of titanium or a titanium  
15 alloy, Titanium-6Al-4V being preferred.

16   Brief Description of the Drawing

17           Fig. 1 is a schematic cross-section of a  
18 battery header in accordance with the invention, and

19           Fig. 2 is a schematic cross-section of a  
20 feedthrough with sleeve according to the invention  
21 combined with a metal container for use as an  
22 electrochemical cell.

23   Description of the Preferred Embodiments

24           While this invention may be embodied in many  
25 different forms, there are shown in the drawings and  
26 described in detail herein specific preferred embodiments  
27 of the invention. The present disclosure is an  
28 exemplification of the principles of the invention and is  
29 not intended to limit the invention to the particular  
30 embodiments illustrated.

31           Referring to Fig. 1, a header of typical  
32 construction is shown which includes a center pin or  
33 terminal 10, a glass seal member 12 and an outer member  
34 14. This arrangement and that of Fig. 2 are typical  
35 feedthrough seal arrangements which may make use of the  
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1 invention. Other arrangements may be used as well and  
2 may take any configuration in which the metal is wetted  
3 by the glass.

4 Referring now to the Fig. 2 the invention in a  
5 preferred form includes a terminal 10 extending through  
6 a glass seal 12 which is received into a sleeve or header  
7 14. Sleeve 14 may be welded into an opening in a battery  
8 container 16 of, for example, stainless steel.

9 The assembly, requiring forming weights, is  
10 placed in an oven or furnace and heated causing the glass  
11 to wet the metallic components forming a hermetic seal  
12 between the glass and the metal components. Such a  
13 feedthrough may thereafter be welded if necessary, into  
14 any desirable container or the like.

15 In its preferred form, terminal 10 consists  
16 essentially of niobium, or titanium or an alloy thereof.  
17 Sleeve 14 is of titanium or a titanium alloy Ti-6Al-4V  
18 The glass 12 is CABAL-12, which is of the following  
19 composition:

20	<u>Composition</u>	<u>Wt. %</u>
21	Al <sub>2</sub> O <sub>3</sub>	20
22	B <sub>2</sub> O <sub>3</sub>	40
23	CaO	20
24	MgO	20

25  
26 The combination of materials described forms a  
27 compression seal which is hermetic and corrosion  
28 resistant.

29 This completes the description of the preferred  
30 and alternate embodiments of the invention. Those  
31 skilled in the art may recognize other equivalents to the  
32 specific embodiments described herein, which equivalents  
33 are intended to be encompassed by the claims attached  
34 hereto.

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1           Having described the invention, the exclusive  
2 rights and privileges thereto are to be defined by the  
3 foregoing claims in the light of the foregoing  
4 description.

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1 WHAT IS CLAIMED IS:

2 1. An electrical feedthrough comprising an  
3 electrical terminal selected from the group consisting of  
4 niobium, tantalum molybdenum, Titanium, titanium alloys,  
5 or alloys of any of the foregoing, a glass insulator of  
6 the CABAL-12 composition Type positioned around a portion  
7 of the terminal and in sealing engagement therewith and a  
8 sleeve or header comprised of a titanium or a titanium  
9 alloy positioned around a portion of the glass insulator  
10 for receiving same in sealing engagement therewith.

11 2. The feedthrough of Claim 1 in which the sleeve  
12 or header titanium alloy is Ti-6Al-4V.

13 3. A glass/metal feedthrough seal of the  
14 compression type including an electrical terminal  
15 selected from the group consisting of niobium, tantalum,  
16 molybdenum, titanium, titanium alloys or alloys of any of  
17 the foregoing; a glass insulator of the CABAL-12  
18 composition type positioned around a portion of the  
19 terminal and in sealing engagement therewith and a sleeve  
20 or header consisting essentially of titanium or a  
21 titanium alloy positioned around a portion of the glass  
22 insulator for receiving same in sealing engagement  
23 therewith.

24 4. The feedthrough of Claim 3 in which the  
25 titanium alloy is Ti-6Al-4V.

26 5. An electrochemical cell of the type including  
27 corrosive contents in a container and wherein the  
28 container includes an opening carrying an electrical  
29 terminal which extends from the exterior of the cell  
30 through the opening and into the interior thereof; a  
31 feedthrough assembly positioned in the opening and around  
32 the terminal, the assembly comprising; a sleeve or header  
33 attached to the container, the sleeve or header  
34 consisting essentially of titanium or a titanium alloy  
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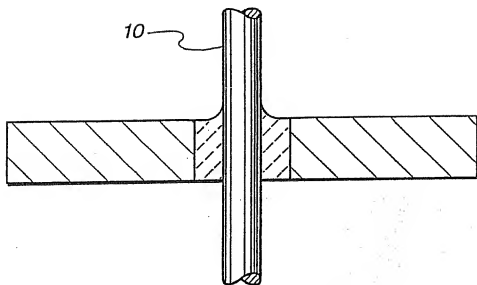
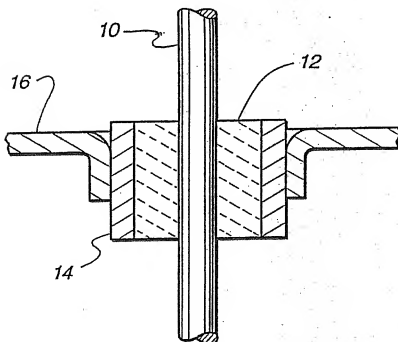
1 and a glass seal carried by the sleeve or header and  
2 surrounding the terminal in sealing engagement therewith,  
3 the glass being of the CABAL-12 composition type.

4 6. The cell of Claim 5 in which the feedthrough  
5 seal is hermetic and of the compression type by virtue of  
6 including a terminal of niobium, tantalum, molybdenum,  
7 titanium, a titanium alloy or any alloy or any of the  
8 foregoing.

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*Fig. 1**Fig. 2* ✓

# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US90/05623

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>2</sup>		
According to International Patent Classification (IPC) or to both National Classification and IPC		
INT(5):	HOLM 2/06	US CL.: 429/181
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>4</sup>		
Classification System	Classification Symbols	
US	429/181	174/152GM, 50, 61
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>		
Category <sup>*</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>
Y	US, A, 4,421,947 (KYLE) 20 December 1983 Col. 6, lines 21-32.	1-6
Y	US, A, 4,55,613 (TAYLOR ET AL.) 03 December 1985 Cols. 4 and 5, lines 62-100.	1-6
A	US, A, 4,180,700 (KRASKA ET AL.) 25 December 1979	
A	US, A, 4,271,278 (PHILLIPS ET AL.) 02 June 1981	
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A	EP, A, 269,007 (HUBNER) 01 June 1988	
A	US, N, (RHEE) Wetting of Ceramics by Liquid Metal, Journal of the American Ceramic Society, pages 332-334, Vol. 54, No. 7.	
A	US, A, (BUNKER ET AL.) Development of Corrosion Resistant Glasses for Ambient Temperature Lithium Batteries, Sandia National Laboratories, 02 December 1981, pages 1-7.	
A	US, N, (BUNKER ET AL.) Ampule Tests to Simulate Glass Corosion in Ambient Temperature Lithium Batteries, Vol. 2, Sandia Report SAND83-230 $\frac{1}{2}$ , June 1984.	
<p><sup>*</sup> Special categories of cited documents: <sup>15</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search <sup>19</sup>		Date of Mailing of this International Search Report <sup>20</sup>
12 DECEMBER 1990		05 FEB 1991
International Searching Authority <sup>1</sup>		Signature of Authorized Officer <sup>20</sup>
ISA/US		DONALD L. WALTON